CLAIMS

1. A method of forming a vibration damping coating on a metallic substrate comprising applying to a surface of the metallic substrate by plasma spraying a coating comprising a spinel having regions of relative oxide or nitride imbalance; said spinel further characterised by the presence of at least about 85,000 effective interface and defect zones per square millimetre, or at least about 100,000 orientated grain boundaries and microcracks per square millimetre, or both.

2. A method according to claim 1, wherein the metallic substrate comprises a titanium alloy.

3. A method according to any one of the preceding claims, wherein the spinel includes a molar excess of one of the oxides on which the spinel is based.

4. A method according to any one of the preceding claims, wherein the molar excess of the oxide is within about 7% of equimolar.

5. A method according to any one of the preceding claims, wherein the spinel includes at least one introduced nitride and/or oxide.

6. A method according to claim 5, wherein the introduced oxide and/or nitride is selected from nitrides and oxides of: zirconium, yttrium, silicon, alumium, calcium, titanium, boron, hafnium, tungsten, nickel, niobium, iron, chromium, titanium, vanadium, manganese, molybdenum, cerium, cobalt, barium, praseodymium, neodymium, samarium, gadolinium, erbium and strontium.

7. A method according to claim 5 or claim 6, wherein the introduced nitride and/or oxide is present in an amount up to about 40% by total weight of the coating material.

8. A method according to any one of the preceding claims, wherein the spinel is magnesia-alumina spinel.

9. A vibration-damped structure comprising a metallic substrate and a vibration damping coating applied to said substrate by plasma spraying, wherein the coating comprising a spinel having regions of relative oxide or nitride imbalance, said spinel further characterised by the presence of at least about 85,000 effective interface and defect zones per surface square millimetre, or at least about 100,000 orientated grain boundaries and microcracks per surface square millimetre, or both.

10. A structure according to claim 9, which comprises an aerospace component or a portion thereof.

11. A structure according to claim 9 or claim 10, when produced by a method according to any one of claims 1 to 8.

12. A particulate spinel material wherein at least some of the particles have a relative oxide or nitride imbalance with respect to other ones of the particles, or wherein at least some of the particles have regions of relative oxide or nitride imbalance within the particle, or both.

13. A particulate spinel material according to claim 12, wherein the relative oxide or nitride imbalance is provided by a precursor of an oxide or nitride, respectively, which precursor is capable of being converted to an oxide or nitride in the coating application method.

14. A particulate spinel material according to claim 13, wherein calcium carbonate is present as a precursor of calcium carbonate.

15. A particulate spinel material according to any one of claims 12 to 14, which consists essentially of the said particles, optionally together with particles of stoichiometrically balanced spinel material.

16. A particulate material according to any one of claims12 to 15, wherein the particles are sufficiently fine to melt in a plasma flame during the process of application to coat a metallic substrate

17. A particulate material according to any one of claims 12 to 16, wherein the particles are in the form of particulate agglomerates of smaller particles which can disintegrate or fragment in a plasma flame during the process of application to provide in the flame a stream of molten particles for the application of the coating to the substrate.

18. A particulate material according to any one of claims 12 to 17, in the form of a dry powder.

19. A particulate material according to any one of claims 12 to 18, comprising in admixture a first particulate spinel material in which one of the oxides of the spinel and/or an introduced oxide and/or nitride is in a molar excess and a second particulate spinel material in which the other of the oxides of the spinel and/or an introduced oxide and/or nitride is in a molar excess, optionally together with further particulate spinel materials of different composition whether stoichiometrically balanced or unbalanced.

20. A particulate material according to claim 19, consisting essentially of the said particulate spinel materials.

21. A particulate material according to any one of claims 12 to 18, comprising particles comprising internal domains of a first spinel material in which one of the oxides of the spinel and/or an introduced oxide and/or nitride is in a molar excess and a second spinel material in which the same oxide is present in a

different molar excess or the other of the oxides of the spinel and/or an introduced oxide and/or nitride is in a molar excess, optionally together with further spinel domains of different spinel composition whether stoichiometrically balanced or unbalanced.

22. A particulate material according to claim 21, consisting essentially of the said particles.

23. A particulate material according to any one of claims 12 to 22, for use in a method according to any one of claims 1 to 8.

24. Use of a spinel having regions of relative oxide or nitride imbalance in a surface coating of a metallic substrate, for the purpose of damping vibrations in the metallic substrate.

25. Use of a spinel having regions of relative oxide or nitride imbalance in a surface coating of a metallic substrate wherein the spinel is applied to said substrate by plasma spraying to form a coating characterised by the presence of at least about 85,000 effective interface and defect zones per surface square millimetre, or at least about 100,000 orientated grain boundaries and microcrack per surface square millimetre, or both; said coating being for the purpose of damping vibrations in the metallic substrate.

26. A method of forming a vibration damping coating on a metallic substrate, substantially as herein described with reference to the Example.

27. A vibration damped structure, substantially as herein described with reference to the Example.

28. A particulate spinel material, substantially as herein described with reference to the Example.

29. A use of a spinel for the purpose of damping vibrations in a metallic substrate, substantially as herein described with reference to the Example.